REMARKS

TFT is a well-known abbreviation for "thin film transistor." It is well-known in the art that a "TFT" is an essential component of active matrix flat panel displays. This is the most common type of liquid crystal display (LCD).

The Examiner is respectfully requested to reconsider the rejection of Claims 1, 2, 5 - 8, and 10 under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art found in the specification in view of Kumar, et al. (U.S. Patent 5,512,131).

Applicant reiterates that the object of the present invention is top form a microcontact printing stamp which possesses a minimum degree of printing distortion. The method of making the improved stamp of the present invention which stamp has a pattern for microcontact printing utilizes a siloxane wherein the siloxane is cured to fix its geometry while at or near the intended final use temperature, followed by a higher temperature step to harden the siloxane, without substantially inducing geometry changes to the stamp and the pattern.

Applicant teaches that the pattern fabricated onto the stamp should represent in detail the desired pattern intended to be printed. While this concept may appear in general to be obvious, the extraordinary detail that must be conveyed with microcontact printing makes this faithful representation easier to state as a goal than to realize in practice. Kumar et al. do not form such an improved article.

The stamp, once made, must have mechanical properties, such as elastic modulus, that allow handling during printing, and minimum additional distortion from the stresses incurred during printing contact. While it is possible to do either separately, it has proven to be a severe fabrication challenge to achieve both simultaneously. Kumar et al. do not form such an improved article.

The present invention comprises a simple technique with respect to microcontact printing stamps, to achieve both the required dimensional integrity for pattern faithfulness and desired mechanical properties, primarily high elastic modulus. It teaches that with the vinyl addition type siloxane precursor mixtures (and others), where crosslinking (curing) can take place at either room temperature or higher temperature, a two-step cure produces the desired combination of properties.

The first step is a room temperature cure, since generally room temperature is the condition at which the stamp will be ultimately used. The stamp is allowed to crosslink at room temperature for some period, <u>for example one week</u>. This one week curing is contrary to the 30 minute cure disclosed by Kumar at column 18, line 62 as cited by the Examiner. During this period of time, the stamp crosslinks and fixes the overall stamp geometry and the printing pattern in a manner far superior to and not contemplated by Kumar, et al.

After this curing step is completed, the second step commences wherein the stamp is brought to a higher temperature, in the vicinity of 60 ° C, at which temperature a further cure continues thus attaining a higher elastic modulus. Upon cooling back to room temperature, the original pattern is restored without distortion and the stamp has the desired higher modulus.

Based upon the content of the rejection in the Official Action, it appears that the examiner misunderstands the invention as claimed. The two-step processing described above is used with the intention of using the first step to establish the precise dimension of the molded pattern. The step establishes not just the relative geometry, but also the resulting dimension by being held at a precise temperature. Then, once this dimension has been irrevocably established, the material is heated to a higher temperature for hardening.

Received from < 860 210 0702 > at 4/15/03 10:47:09 PM [Eastern Daylight Time]

Even though the material will (and does) expand during the higher temperature curing, it will (and does) shrink back to its original dimension again after cooling to the final use temperature.

Kumar et al acknowledge that their process is imperfect where they state that their (imperfect) process does cause significant shrinking of the pattern (see column 8, lines 15-30). Kumar, et al. concede that their process does not produce a reproducible product and they concede that they have no control over obtaining reproducible results by rationalizing that the shrinking which is inherent in their process can have advantages because it results in further miniaturization.

By way of contrast, Applicant unequivocally states (as it is his objective) that the advantage of his invention is that he is able to make the desired pattern at the exact planned-for dimension, and concurrently, he offers a way to prevent the permanent shrinkage of the formed article which is inherent in the prior art reference to Kumar, et al.

More specifically, with respect to the processing method of Kumar, et al., there are differences which result in a finished product which is a different in kind rather than degree. Kumar, et al. disclose that they first allow the precursor material which is to be formed into the elastomeric stamp to set in the mold for about an hour at room temperature before inserting the mold into the oven. This step, which is a "precure" step, is only superficially similar to the instant process. During the one hour precure step of detailed by Kumar, et al. a modification of the viscosity of the precursors, e.g., the Sylgard and similar systems discussed, will occur. This modification of precursor may provide some handling benefits; e.g., not having the precursor solution flow out of the mold while lifting and positioning the mold in the oven. It is essential to note however, that the dimensions of the Kumar, et al. pattern are not fixed during the mere 1 hour precure at ambient temperature.

Received from < 860 210 0702 > at 4/15/03 10:47:09 PM (Eastern Daylight Time)

In the method of the present invention, the mold is filled with precursor material and this mold/precursor remains at a precisely controlled end-use temperature for many days or up to a week. This establishes the final cured dimensions of the microcontact printing stamp by having allowed a great majority of crosslink reactions to take place at that final use temperature. The final high temperature reaction cures and hardens the material but does so by reacting only a small residual number of crosslink sites; thereby hardening the element without inducing significant additional chemical shrinkage. Once the product cools down after the high temperature second step, it regains the dimensions it attained during the first long end-use temperature reaction, except for insignificant additional chemical shrinkage caused by the residual crosslinking that took place at the high temperature. It is rendered insignificant by expressly inverting the proportion of chemical crosslinks that are created at each of the two temperatures.

In the method described in Kumar, et al., and others, an insignificant proportion of the crosslinking is created during the room temperature reaction and the vast majority of crosslinking is created at the elevated temperature at which the article is cured. In the process of the present invention, the opposite is true. The vast majority of crosslinking is made to take place at room temperature (by extending the time at that temperature to many days or weeks) and only an insignificant proportion takes place at the higher temperature at which the article is cured.

In reviewing the instant specification and the Kumar, et al. reference cited, certain general similarities do exist, however the specific details of Applicant's invention result in a substantial difference. It is in those differences that the patentability of the present invention resides. The specificities embodied within the instant invention and the lack of relevant disclosure in the Kumar, et al reference render the Kumar, et al. reference an inappropriate reference with respect to Applicant's invention. The Examiner has applied the rejection using the references discussed above, using <u>selective combinations</u> to render obvious the invention without recognizing the substantial differences that exist.

Received from < 860 210 0702 > at 4/15/03 10:47:09 PM [Eastern Daylight Time]

The Examiner is requested also to reconsider the rejection of claims 3 and 4 under 35 U.S.C. 103(a), in view of Kumar, et al. in further view of Kim, et al. (U.S. Patent 6,355,198).

With respect to Kumar, et al., reference is made to the comments presented above with respect to the teaching contained therein, and such comments are hereby incorporated herein with respect to this rejection.

With respect to the Kim, et al. reference, not only does this patent deal with an entirely different process, but in the disclosure of the two-step curing process found on column 10, (lines 1 -25) it is clear that their teaching is very different from the teaching of the present invention. Kim, et al. disclose the curing of a molded part in two steps where the purpose of the first step is to harden it sufficiently only to become self-supporting so that it can be removed from the applicator without losing it's form, to allow handling and retain its shape during further hardening. This disclosure is merely the typical purpose of a prebake - to establish a general shape that can be maintained.

This reference says nothing about maintaining a precise dimension. Shape is NOT dimension. Most assuredly the Kim, et al. parts will undergo significant shrinkage during the higher temperature hardening (as does Kumar, et al.'s). The method of the present invention prevents exactly this and differs in this way from Kumar, et al., Kim, et al., and other typical 2-step curing processes.

Kim, et al. is a "shot gun" type disclosure. It appears from a review of the reference that if a polymer resulting from one or more of the catalog of monomers cited therein has the appropriate structure, it is allegedly suitable for use in their invention.

Received from < 860 210 0702 > at 4/15/03 10:47:09 PM [Eastern Daylight Time]

Considering the number of elements that are disclosed in the Kim, et al. reference, the permutations and combinations of constituents set up would not render the composition used the present invention anymore obvious than any of the other thousands of blends that are disclosed.

The rejection uses only so much of the disclosures found in the secondary references as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such references, alone and in combination fairly suggest to one of ordinary skill in the art.

The Examiner is requested also to reconsider the rejection of claim 9 under 35 U.S.C. 103(a), in view of Kumar, et al. in further view of Kim, et al. (U.S. Patent 6,355,198) in further view of Sangokoya (U.S. Patent 5,731,253).

Applicants concede that Kumar, et al. do describe the use of polydimethyl siloxane, just as Applicant does. However Kumar, et al. cure the composition in a very different way, and a way that by their own admission would result in shrinkage (column 8 lines 15-30). Again, this is the substantial difference in kind and not in degree which is necessary to establish "invention."

Kim, et al. discloses in general terms the many different materials of a sol-gel forming type. Typical examples include SiO_2 (quartz), ZnO, $PbScTaO_3$, etc., but not elastomeric organic/inorganic polymers of the siloxane type. These are very different materials from the siloxane rubber disclosed by Applicants.

Sangokoya, similarly to Kim, et al., discloses an entirely different class of materials. These are aluminoxane derivatives and siloxy-aluminoxane materials used to enhance catalytic effect for polymerization. The reference speaks in general terms of reaction temperatures being in the range of 25 °C to 150 °C, but Sangokoya says nothing about tailoring curing conditions to precisely define the dimension and geometry of molded parts from these materials.

And more specifically, Sangokoya does not mention two step curing, or does he mention long carefully-controlled end-use temperature cures followed by high temperature hardening steps.

In the Examiner's "Response to Arguments" section of the Official Action, as noted above, in Kumar, et al., : 1) patentees acknowledge their method will cause shrinkage but offer no way to eliminate or minimize it. Indeed, they rationalize this by claiming shrinkage is desirable because it further miniaturizes the pattern. The standard practice in applications of this type, one does not seek to further miniaturize a pattern beyond what the optical mask defined when making the mold "master." Indeed, except in specialized rare cases such changes are highly problematic. The method of the present invention offers a way to significantly reduce and at best totally eliminate such changes. The ability to reproduce results from method end product to method end product is achieved, which is not the case in the prior art alone or in combination.

2) Kumar, et al. use a 2-step cure only in the extreme and broadest sense that they leave the precursor for an hour or so at room temperature after casting before putting it into high temperature oven. Such a time (i.e., one hour) will not result in a fixing of the pattern dimension, but only in establishing the shape and pattern. Applicant emphasizes that his purpose is to gain control over single-digit micrometers in dimension over a total dimension of tens of inches. He seeks such control over these phenomenal scale ratios because of the need for registration of one microscopic circuit pattern with another in a

different layer of the circuit which in the example case, are pixels and associated "TFTs"(Thin Film Transistor) and wiring on a flat panel display.

3) Applicants uses PRECISE control of temperature DURING the "room temperature" stage of the cure. Applicant uses the term "room temperature," but this is the end-use temperature, which is held very constant in a semiconductor clean-room setting. The molding is to be done at that precisely held and maintained temperature. In order to do so, it is necessary to do the curing either in such a temperature controlled environment as a clean room (e.g. make the stamps in a clean room wherethey will ultimately be used in microcontact printing operations) OR be kept under tightly controlled temperature conditions by hermetic sealing and immersion in a temperature controlled fluid bath.

The Examiner speaks of a cure period of "some period." The period is totally different from Kumar, et al. and there are no similarities with Kumar, et al. The methods are not similar for two reasons: 1) there are substantially different scales of time for Applicant's relative steps. Applicant's first step as mentioned above is measured in days or weeks. Kumar, et al.'s time span is measured in hours. Such orders of magnitude of leaps in scale cannot be construed as obvious.

2) The Kumar, et al. initial cure is just that - initial. As a result, only a tiny fraction of crosslinking takes place. Just enough that only more convenient handling is accomplished before putting it in the oven for the full cure. Their method does not fix the geometry in any but the most basic sense of shape. But, it does not fix any absolute dimension at end-use temperatures as the present invention method does. In the Kumar, et al. methodology, the majority of crosslinking takes place while the mold and the part are in an expanded dimension - exactly what the present invention seeks to avoid. Further, by fixing the geometry at high temperatures far from the end-use temperature, there is the additional problem of introduction of non-uniform stress upon cooling. This causes greater distortion in the final part.

With respect to the Examiner's reference on page 7 to siloxane as the material shown in Kumar, et al. and Kim, et al., the materials of Kumar, et al. are largely the same (siloxanes) but the material set of Kim, et al. is totally different. The Kim, et al. materials are intended to be used as catalysts and bear little chemical or physical relationship to the elastomers of the present invention. Their materials do contain Si and O atom types, and a bond between them, but this is true in many unrelated materials - including beach sand (SiO_2). It has no chemical relevance to this patent.

As to the references considered to be of interest, Sangokoya bears no relation to the present invention.

Dominguez - 1) The reference speaks specifically about polyurethanes. Curing conditions are material specific. Applicant exemplifies siloxanes. Just as Dominguez said in referring to his system, "surprisingly" about the benefits of degradative curing curing for their system, Applicant says "surprisingly" to the benefits of the week-long uninterrupted end-use temperature cure followed by the higher temperature (but not degradatively high as in the case of Dominguez) hardening step.

2) Dominguez discloses a reaction injection molding(RIM) first step followed by a post cure. An essential difference is that Applicant cures for days or a week at the initial temperature while holding at precisely controlled end-use temperature. Their process is typical for molding macroscopic parts via RIM processing. The time scale of the initial cure is vastly different and led to unexpected behavior with significant advantages in molding patterns where precise control of absolute pattern dimension is critical.

Received from < 860 210 0702 > at 4/15/03 10:47:09 PM [Eastern Daylight Time]

The McDougal patent involves the use of microencapsulation of a catalyst system for siloxane curing. Upon application of heat and pressure the catalyst containing microcapsules burst releasing the catalyst at which point curing commences. There is no relationship to the present invention.

Applicants respectfully submit that the specificity of the Kumar, et al. and Kim, et al. disclosures does not rise to the level required to qualify as an appropriate reference with respect to Applicant's invention.

> Further, the reference must describe the applicant's claimed invention sufficiently to have placed a person of ordinary skill in the field of the invention in possession of it. (Citations omitted) In re Lonnie T. Spada et al., 911 F.2d 705, 708 (Fed. Cir. 1990)

Kumar, et al. and Kim, et al., alone or in combination, do not disclose or even imply the specific composition of the present invention as presently claimed. In her rejection, the Examiner is picking and choosing elements to the exclusion of what the references as a whole teach to one skilled in the art.

In order to analyze the propriety of the Examiner's obviousness rejections in this case, a review of the pertinent applicable law relating to 35 U.S.C. § 103 is warranted. The Examiner has applied the Kumar and Kim references using selective combinations to render obvious the invention.

The Court of Appeals for the Federal Circuit has set guidelines governing such application of references. These guidelines are, as stated are found in Interconnect Planning Corp. v. Feil, 774 F.2d 1132, 1143, 227 USPQ, 543, 551:

> When prior art references require selective combination by the court to render obvious a subsequent invention, there must be some reason for the combination other than hindsight gleaned from the invention itself.

Received from < 860 210 0702 > at 4/15/03 10:47:09 PM [Eastern Daylight Time]

A representative case relying upon this rule of law is Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 5 USPQ 2d 1434 (Fed. Cir. 1988). The district court in Uniroyal found that a combination of various features from a plurality of prior art references suggested the claimed invention of the patent in suit. The Federal Circuit in its decision found that the district court did not show, however, that there was any teaching or suggestion in any of the references, or in the prior art as a whole, that would lead one with ordinary skill in the art to make the combination. The Federal Circuit opined:

> Something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. [837 F.2d at 1051, 5 USPQ 2d at 1438, citing Lindemann, 730 F.2d 1452, 221 USPQ 481, 488 (Fed. Cir. 1984).]

Applicants respectfully submit that there is no basis for the combination of the Kumar, et al. and Kim, et al. references cited by the Examiner. The Examiner has selected curing steps or physical characteristic specifications from these disparate references for the sake of showing the individual elements claimed without regard to the total teaching of the references. As noted, the Examiner is improperly picking and choosing. It is a piecemeal construction of the invention. Such piecemeal reconstruction of the prior art patents in light of the instant disclosure is contrary to the requirements of 35 U.S.C. § 103.

> The ever present question in cases within the ambit of 35 U.S.C. § 103 is whether the subject matter as a whole would have been obvious to one of ordinary skill in the art following the teachings of the prior art at the time the invention was made. It is impermissible within the framework of Section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. (Emphasis in original) In re Wesslau 147 U.S.P.Q. 391, 393 (CCPA 1965)

This holding succinctly summarizes the Examiner's application of references in this case because she did in fact pick and choose so much of the Kumar, et al. and Kim, et al. disclosures (as well as that from Sangokoya with respect to claim 9) to support her position and did not cover completely in the Office Action the full scope of what these varied disclosure references fairly suggest to one skilled in the art.

There is no proper basis for combining the totally different disciplines of Kumar and Kim (and Sangokoya) as has been done in the Official Action.

Further, the Federal Circuit has stated that the Patent Office bears the burden of establishing obviousness, and that this burden can only be satisfied by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the reference.

> Obviousness is tested by "what the combined teachings of the references would have suggested to those of ordinary skill in the art." In re Keller, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981). But it "cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination." ACS Hosp. Sys., 732 F.2d at 1577, 221 USPQ at 933. [837 F.2d at 1075, 5 USPQ 2d at 1599.]

The court concluded its discussion of this issue by stating that teachings or references can be combined only if there is some suggestion or incentive to do so.

In the present case, the skilled artisan viewing the any or all of the references would be directed toward a totally different system than is called for in the present invention.

Applicant has attempted to distinguish the invention as embodied in the amended claims over the prior art and the cited paragraphs of 35 U.S.C. § 112. In view of the arguments and modifications to the claims, allowance of this case is warranted. Such favorable action is respectfully solicited.

Received from < 860 210 0702 > at 4/15/03 10:47:09 PM [Eastern Daylight Time]

If there are issues which could be resolved by a telephone conference, Applicant's attorney would be willing to speak with the Examiner concerning such matter(s) at a mutually convenient time. The Examiner is requested to contact Applicant's attorney by telephone.

Respectfully Submitted,

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I hereby certify that this paper is being telefaxed on the date indicated below to the U.S. Postal Service at fax number (703) 872-9310 and addressed to Commissioner of Patents & Trademarks, Washington, D.C. 20231 care of Group Art Unit 1732.

April 15, 2003

Name: Thomas A. Beck

APPENDIX B

VERSION WITH MARKINGS TO SHOW CHANGES MADE

37 C.F.R. § 1.121(b)(iii) AND (c)(ii)

SPECIFICATION (Amended) Page 5

mixture contained, is loaded into an oven. The oven can either be preheated to some temperature, or ramped to some temperature. Typically temperatures of 60 °C to 120 °C are used. After some time, typically from 1 hour to 24 hours at a temperature sufficient to ensure full cure, the mold is allowed to cool to room temperature. The bolts undone, and one half of the casing is removed to expose a sandwich type structure consisting of backplane, siloxane, and master.

The stamp with affixed backplane is separated from the photoresist/glass master to complete the process.

A series of sources for severe pattern distortion in this standard process result by virtue of the curing of the siloxane at higher temperatures than the final use temperature (room temperature). One reason for the distortion noted above is that each component of the mold, including the master with glass and photoresist, flexible backplane, spacers, and mold housing expands with temperature changes according to the CTE (Coefficient of Thermal Expansion) each. Thus, each component of the structure, being made of a different material with a different coefficient of expansion, expands disproportionally relative to each other, and to the original intended pattern. These will be the dimensions in place at the time of curing when the siloxane hardens into a stamp, and the pattern becomes fixed.

At this point, with the oven hot and after sufficient time for curing, the stamp possesses a pattern dimension that is related to the original master pattern according to the composite CTE of the master glass and photoresist. As the glass and photoresist will have expanded more or less uniformly, the stamp pattern will differ from the original in a relatively predictable way, which would be able to be reasonably compensated for by choice of an appropriately scaled master pattern to begin with. This sequence would produce a useful product if this were the end of the fabrication process, but it is not. Before the stamp is separated from the mold, the entire assembly must first be cooled down. During cooling, the master will shrink according to its moderate CTE (maybe 20 to 40 ppm). The stamp itself will shrink very significantly with a CTE of about 500 to 800 ppm, and the affixed backplane will shrink with a CTE of around 5 to 50

-5-

Received from < 860 210 0702 > at 4/15/03 10:47:09 PM [Eastern Daylight Time]

(Amended) Page 10

careful investigation where the bulk modulus was measured before and after the post-cure heating indeed showed that the modulus was brought to the same or nearly the same higher value as achieved by curing to that higher temperature right from the start. This finding was confirmed to be repeatable.

Thus, the invention separates the curing of the siloxane (or other material) stamp into two stages. The first stage accomplishes the vast majority of chemical crosslinking while constrained by the master pattern at the intended pattern dimensions.

The second stage hardens the material without inducing significant further permanent geometrical changes to the pattern. Thus, both necessary stamp requirements, which are usually mutually exclusive, are met simultaneously by this method.

<u>The method of the present invention may be used in manufacturing a common type of liquid crystal display (LCD) flat panel display wherein TFT (Thin Film Transistor-an essential component of active matrix flat panel displays) and wiring dimensions contained therein are microscopically small and the registration of subsequent layers of such display is within microns over many inches.</u>

Thus, while there have been shown, described and pointed out fundamental novel features of the invention as applied to currently preferred embodiments thereof, it will be understood that various omissions and substitutions and changes in the form and details of the method and apparatus illustrated, and in their operation, may be made by those skilled in the art without departing from the spirit of the invention. In addition it is to be understood that the drawings are not necessarily drawn to scale but that they are merely conceptual in nature. It is the intention, therefore, to be limited only as indicated by the scope of the claims appended herewith.

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